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When Adaptations Go Awry: Functional and Dysfunctional Aspects of Social Anxiety

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Abstract

Adaptations are psychological and behavioral mechanisms designed through evolution to serve specific purposes ultimately related to reproductive success. Although adaptations are inherently functional, in some cases their operation can nevertheless cause personal and social dysfunction. We describe a theoretical framework for understanding, predicting, and reducing the dysfunctional consequences of psychological adaptations. We discuss three general sources of dysfunction: a) the existence of adaptive tradeoffs, b) mismatches between current environments and ancestral environments, and c) individual differences. The paper applies this framework primarily to the topic of social anxiety, a psychological phenomenon marked by concerns pertaining to social rejection and embarrassment. Although social anxiety can serve useful functions, it can also involve excessive worry, negative affect, and avoidance of social situations, leading to significant distress and social impairment. We consider sources of dysfunction in social anxiety and discuss implications for policy, including recommendations for psychological, situational, and biological interventions. We also discuss broader applications of this theoretical framework to other areas of social life.

What do anxiety disorders, domestic violence, racial prejudice, and obesity all have in common? On the surface, these phenomena might seem to have little to do with one another. After all, each involves a distinct type of social problem, each is triggered by a different social context, and each entails different negative consequences for individuals and for society.

Yet, when one looks deeper, these social problems actually share quite a bit in common. Each reflects the operation of psychological mechanisms that were designed through evolution to serve important adaptive functions, but that nevertheless can produce harmful consequences. Indeed, although some evolved mechanisms are highly adaptive at one level, they can be highly destructive at another level. An evolutionary perspective is useful for identifying such mechanisms and understanding how they operate. Consequently, an evolutionary perspective can provide useful information for developing policies and interventions aimed at ameliorating the problems these mechanisms sometimes cause.

For example, substantial evidence suggests that humans are evolved to live in relatively small, tightly-knit groups consisting primarily of biological kin; such groups provided consistent sources of social support (Dunbar, 1992). In contrast, people in modern societies often lack such sources of social support, instead spending more of their time with a much wider variety of individuals, including distant acquaintances and complete strangers. This mismatch between modern and ancestral environments can cause people to experience substantial social anxiety and distress. One implication is that, to reduce anxiety, social policies should encourage and facilitate greater interaction with biological kin (e.g., financial incentives providing resources for people to relocate closer to their family).

Interventions could also educate people about the increased social capital associated with living closer to family members, and the increased stress associated with living further away.

In this paper we describe a conceptual framework for understanding adaptive sources of dysfunction – for identifying and combating “adaptations gone awry.” There are many examples of psychological and behavioral phenomena that fit within this overall theoretical framework. In the current paper, we focus primarily on social anxiety – a psychological phenomenon marked by concerns pertaining to social rejection and embarrassment – to demonstrate how this approach can suggest specific recommendations for intervention and public policy.

Although social anxiety can serve useful functions, it can also involve excessive worry, negative affect, and exaggerated avoidance of social situations. Understanding the root causes of anxiety-related problems is an essential step in the development of interventions and policies to reduce dysfunction. Indeed, to combat a problematic pattern of behavior, it often is critical to understand not just the problem’s surface characteristics, but also its underlying causes. An evolutionary perspective is useful because it provides unique insight into the specific underlying mechanisms that promote social and psychological problems.

From an evolutionary perspective, social anxiety is designed primarily to help people ensure an adequate level of social acceptance and, throughout most of human history, this meant acceptance in a tightly-knit group based primarily of biological kin (Baer & McEachron, 1982). Relative to the evolutionary past, social relationships in modernized western societies tend to involve a much wider variety of relationships, along with relatively less immediate connection with close, kin-based support networks (Daly & Wilson, 1997). Such insights can help identify individuals at risk for experiencing dysfunctional forms of anxiety (e.g., those lacking in close social connection with kin or whose core social networks have been disrupted) and can inform public policy, directing resources toward programs useful for helping people strengthen their core social networks. For example, this approach suggests benefits to helping people strengthen bonds with biological kin, who tend to provide relatively greater social support than non-kin (Ackerman, Kenrick, & Schaller, 2007).

Moreover, by highlighting the core mechanisms underlying social anxiety (e.g., basic psychological and biological mechanisms that monitor and evaluate one’s level of social acceptance), an evolutionary perspective can aid in the development of new interventions aimed at reducing problematic anxiety symptoms. Such interventions can usefully target the specific psychological processes (e.g., attention to signs of social threat) and biological processes (e.g., endocrinological responses to negative social events) that give rise to dysfunction (see Maner, Miller, Schmidt, & Eckel, 2008; Schmidt et al., 2009). Indeed, contrary to an all-too-common misconception, evolved psychological processes are not immune to change, but instead are dynamically calibrated with ongoing events in the environment (Crawford & Anderson, 1989; Kenrick, Li, & Butner, 2003). Hence, the current paper applies an evolutionary perspective to highlight potential implications for intervention and public policy.

At a broader level, the goal of this paper is to provide an overarching framework for understanding and combating maladaptive consequences of adaptive psychological mechanisms. Thus, in addition to the paper’s focus on anxiety, we will briefly discuss a range of examples throughout the paper to illustrate the broader utility of the theoretical approach.

Overview: Adaptations Gone Awry

Human beings are an ultra-social species capable of immense prosociality, and evolutionary perspectives have provided insight into some of the basic foundations of this prosociality (Axelrod & Hamilton, 1981; Trivers, 1971; Wilson, Van Vugt, & O’Gorman, 2008). Evolutionary perspectives emphasize the importance of adaptations – psychological and behavioral mechanisms designed through evolution to help people solve the important challenges of everyday life. The existence of such adaptations helps explain people’s ability to maintain harmonious societies, care for other people, and behave altruistically toward one another (Brown & Brown, 2006; Burnstein, Crandall, & Kitayama, 1994; Cosmides & Tooby, 1992; Neuberg, Kenrick, & Schaller, 2010).

Yet, from aggression and international conflict to overpopulation and the destruction of the environment, people display a capacity for great selfishness and antisocial behavior. Can an evolutionary perspective – with its inherent focus on the functionality of human behavior – help explain the occasionally self-destructive and maladaptive side of human nature? Indeed, an evolutionary approach can provide critical insight into the causes of psychological and behavioral dysfunction, as well as into the larger implications of that dysfunction for society (Cosmides & Tooby, 1999; Crawford, 1998; Nesse, 2005; Wilson & Daly, 1992).

Evolutionary perspectives are based on the concepts of adaptation and special design. Some individual organisms have characteristics that enable them, compared to other members of their species, to more successfully exploit the prospects and avoid the perils presented by their local ecology (including the social ecology). Moreover, some individuals are better able to compete with members of their own sex over access to potential mating partners. As a consequence, these organisms tend to be more successful at reproducing and transmitting their genes into future generations. Over many generations of differential reproductive success, these processes—natural selection and sexual selection—produce organisms possessing characteristics that previously conferred relative reproductive fitness. Those features that were selected for because they enhanced the reproductive fitness of the organism’s ancestors are known as *adaptations*. Adaptations are designed to solve specific adaptive challenges that arose in ancestral environments.

It is important to note that most adaptations are not designed to facilitate mating directly (Kenrick, Griskevicius, Neuberg, & Schaller, in press). Successful reproduction involves a diverse array of challenges including protecting oneself from predators and other forms of harm, avoiding contagious diseases, maintaining one’s level of social acceptance, navigating status hierarchies, caring for kin and offspring, and so on (Bugental, 2000; Kenrick et al., 2003; Kenrick, Maner, Li, Butner, Becker, & Schaller, 2002). Adaptations are designed to serve many diverse functions across all domains of life.

Thus, adaptations reflect psychological mechanisms that were designed through evolution to serve specific functions that enhance an organism’s reproductive fitness. Those mechanisms are adaptive in the sense that they help the organism face important social and physical challenges. An evolutionary perspective is thus an inherently functionalist perspective that focuses on the adaptive functions of particular psychological processes.

Although they are designed to serve useful functions, adaptations can nevertheless produce dysfunctional and sometimes highly destructive outcomes. Table 1 illustrates examples of adaptive mechanisms that have been shown to produce maladaptive outcomes. Jealousy, for example, is highly functional in that it leads people to ward off potential sexual and romantic rivals (Buss, Larsen, Westen, & Semmelroth, 1992). However, jealousy also serves as one of the main triggers for relationship violence, particularly among individuals who

experience chronic concerns about possible infidelity (Puente & Cohen, 2003). Thus interventions to reduce domestic violence could usefully target cognitive processes that lead people to overestimate the likelihood of infidelity or the threats posed by potential rivals (Maner, Miller, Rouby, & Gailliot, 2009). Indeed, as Table 1 illustrates, there are variety of mechanisms that serve important functions related to self-protection, status, and mating, but that also serve as sources of dysfunction. Understanding how these mechanisms work paves the way for the development of useful interventions and policies aimed at increasing individual and social well-being.

In this article, we provide an overarching theoretical framework for understanding ways in which evolved mechanisms can produce dysfunctional outcomes. We focus on ways in which adaptations designed to serve important social functions can nevertheless go “awry,” unleashing behaviors that prove harmful for the individual and for society. In the following section, we outline three ways in which adaptive psychological mechanisms can produce maladaptive consequences. They involve: a) the existence of adaptive tradeoffs; b) mismatches between current environments and ancestral environments; c) individual differences.

Tradeoffs: Nothing Good Comes for Free

In facing the challenges of everyday life, organisms necessarily face tradeoffs. Consider, for example, the classic example of the peacock’s tail. On one hand, an ornate tail enhances the peacock’s attractiveness to potential mates, because it signals that the peacock is strong and agile enough to avoid predation, despite carrying around so large a tail. On the other hand, a peacock’s tail can, in fact, draw the attention of predators and is physically unwieldy, making the bird more vulnerable to predation. Thus, although the peacock’s tail serves an important reproductive function (increasing its attractiveness to females), it also has important disadvantages (increasing the likelihood of being eaten). The existence of such tradeoffs can help explain dysfunctional outcomes of adaptive mechanisms – although many mechanisms are adaptive in one way, they can produce harmful consequences in other ways.

The existence of adaptive tradeoffs helps explain many dysfunctional behaviors. Consider the propensity for competition, aggression, and risk-taking often displayed by men. Evolutionary theories presume that those behaviors reflect a suite of mechanisms designed to help men establish dominance over other men and ultimately, to enhance their attractiveness to potential mates (Baker & Maner, 2009; Griskevicius, et al., 2009; Wilson & Daly, 1992). Displaying such behaviors has, historically, increased men’s reproductive success, as women tend to be attracted to men displaying high social dominance (Sadalla, Kenrick, & Vershure, 1987). Thus, aggression, competitiveness, and risk-taking can serve positive reproductive functions. At the same time, however, such behaviors can produce conflict, injury, and death. This example thus highlights an important point: adaptations that are functional in an ultimate reproductive sense may nevertheless be highly dysfunctional in a particular proximate context.

These insights have implications for the development of useful policies and interventions. Understanding that aggression and risk-taking are caused, in part, by evolved motives for social dominance and ultimately, mating, can help inform interventions designed to reduce problematic forms of violence and risk. For example, one of the mechanisms identified as a catalyst for mating-related male risk-taking is a discounting of the long-term consequences of one’s actions. Wilson and Daly (2004), for example, showed that exposure to images of attractive women led men to ignore long-term decision outcomes, thus increasing their desire for short-term gains and their tolerance for immediate risk. Interventions designed to reduce problematic forms of risk-taking, therefore, could focus on contexts likely to prime

mating concerns in men and could lead men to focus greater attention on long-term consequences associated with their decision-making.

Mismatches between Modern and Ancestral Environments: Right Reaction, Wrong Time

A second source of dysfunction involves mismatches between modern and ancestral environments. Psychological adaptations have been designed over thousands of generations of human evolution. The adaptations humans possess today, then, were designed to operate in the Environment of Evolutionary Adaptedness, a composite of the social and physical challenges as they have existed for hundreds of thousands of years (Bowlby, 1969; Cosmides & Tooby, 1992). As such, they may or may not be well-adapted for life in contemporary society (Crawford, 1998).

Many of the challenges people face now are functionally equivalent to those their ancestors faced. Just as human ancestors faced potential danger from poisonous animals such as snakes, so too are people today faced with similar challenges when recreating or working in the outdoors. Consequently, mechanisms designed to help people avoid poisonous animals may operate in essentially the same manner now as they have in the past, leading people to vigilantly attend to and avoid poisonous predators (Ohman & Mineka, 2001). Furthermore, many of the problems involved in getting along with other human beings are quite similar to those faced by human ancestors (Hagen, 2005)

Some of the challenges people face today, however, diverge quite a bit from those faced by their ancestors. Such divergences can lead adaptive psychological mechanisms to “misfire” – to respond in ways that might have been adaptive in the past, but that no longer produce adaptive consequences today. Consider people’s desire for sweet and fatty tasting foods. In ancestral times, sugar and fat typically signaled positive nutritional value (Ramirez, 1990). Consequently, people’s sensory systems are designed to detect the presence of sugar or fat in food, and the brain’s gustatory centers produce desirable taste sensations when those foods are consumed. This would have served our ancestors well, facilitating the choice of beneficial and nutritious foods.

Many foods found in post-industrialized societies, however, contain processed sugars, hydrogenated oils, and other additives that enhance the taste of the food without adding any nutritional benefits. Foods laden with corn syrup, for example, typically contain high numbers of calories and their regular consumption can result in obesity, diabetes, and other problems. Thus, the mismatch between the features of ancestral versus modern foodstuffs can lead adaptive sensory mechanisms to produce maladaptive physiological consequences. The desire for sweet and fat foods promotes health problems, even when this desire operates in a perfectly normal manner and would produce health benefits in the environment for which it was designed.

Understanding the mismatches between current and ancestral environments can help people identify useful targets for intervention. In the case of obesity, given that people’s sensory systems are designed to prefer sweet foods, interventions to foster healthier eating could focus initially on increasing people’s intake of fruits, which are naturally sweet and nutritious. Attempts to increase vegetable intake may be more difficult, as vegetables tend to taste bitter rather than sweet. Notably, many current dietary interventions fail to differentiate between the natural desirability of fruit versus vegetables, and attempt to increase the intake of both at the same time (Williams-Piehota et al., 2006). Incorporating an evolutionary perspective that considers the design of human sensory systems may thus improve existing dietary interventions.

Individual Differences: Too Much of a Good Thing

A third source of dysfunction involves the presence of individual differences in the operation of adaptive psychological mechanisms. Evolutionary theories suggest substantial variation among individuals on a vast range of traits. Individual differences arise, in part, from genetic variation across individuals in interaction with developmental experiences and local ecological factors (Buss & Greiling, 1999). Individual differences can reflect people calibrating their behavior to constraints posed by their local environment, as well as the fact that people can use a variety of strategies to approach common social challenges (Gangestad & Simpson, 2000).

Consider people's desire for social contact. This desire reflects a universal need for social affiliation that is deeply rooted within human evolution (Baumeister & Leary, 1995; Kenrick et al., in press). Throughout human history, maintaining lasting relationships with other people served critical functions associated with personal safety, resource-acquisition, child care, and so on. As a result, virtually all people display a strong need for positive social contact.

Yet, there are also individual differences in the way this need manifests itself in social outcomes (Leary et al., 2006). For example, although everyone needs social affiliation, the way people go about satisfying that need varies across individuals. Many people form and maintain relationships in a way that allows them to satisfactorily foster connections with others. Others, however, display chronically high activation of attachment needs and adopt a pattern marked by clinginess and excessive reassurance-seeking (e.g., people with an anxious attachment style; Mikulincer & Shaver, 2007). At the extreme, people with dependent personality disorder go to inordinate lengths to seek nurturance and support, using coercion and ingratiation to maintain exaggerated closeness with others (Livesley, Schroeder, & Jackson, 1990). Conversely, people with an avoidant attachment style tend to avoid intimacy and thus can fail to satisfy their need for social closeness. Such patterns of behavior can hinder the individual's ability to foster healthy and stable social relationships.

Thus, although mechanisms designed to foster social affiliation may work well within their normal bandwidth of functioning, individual differences in the operation of those mechanisms can produce dysfunctional patterns of behavior (see Brown et al., 2007). In some cases, people at the extreme tails of certain personality distributions can display dysfunctional personal and social tendencies. Such tendencies may not be qualitatively different from those displayed by other people. When the individual differences reflect differences in degree rather than in kind, people at the extreme end of the distribution on some trait can be said to display a normal adaptive mechanism that is currently operating outside of its normal bandwidth. As such, even highly adaptive mechanisms can produce harmful outcomes, when the mechanisms in question operate outside their normal range of functioning.

Understanding how individual differences contribute to dysfunction can help identify particular people likely to benefit from intervention, as well as target the specific psychological processes that lead to dysfunction. For example, to the extent that certain individuals display biases in perceived partner regard (e.g., worrying that their partner will not provide them with unconditional support), interventions that target those biases may help reduce attachment insecurity and associated relationship problems (Simpson & Rholes, in press).

Social Anxiety as an Adaptation Gone Awry

The three sources of dysfunction described above provide a framework for understanding, predicting, and ameliorating dysfunctional patterns of behavior. In the current section we apply the framework to the topic of social anxiety and describe research pertaining to both the functional and dysfunctional aspects of social anxiety.

Anxiety as an Adaptation

Anxiety reflects a complex web of affective and cognitive processes including distress, appraisals of possible threat, attention to threat, pessimistic risk perceptions and judgments, and risk-avoidant decision-making (Eysenck, 1992; Joiner et al., 1999; MacLeod et al., 1986; Maner, Richey et al., 2007; Maner & Schmidt, 2006; Shepperd et al., 2005). Social anxiety, for example, leads people to appraise social situations as threatening and to selectively attend to cues signaling social disapproval (Fox et al., 2001). These processes are designed to monitor signals of potential threat, and to help the individual avoid possible harm. Indeed, this is anxiety's primary function: it heightens people's vigilance to possible sources of threat in the environment and facilitates the rapid engagement of behaviors aimed at avoiding the threat (Maner, 2009).

An anxious person walking through an unfamiliar part of town at night, for example, might be apt to scan dark corners for any sign of movement, and vigilantly listen for any indication that someone might be lurking and ready to pounce. The anxious person is likely also to display signs of chronic arousal, readying the body for fight or flight, depending on the demands of the situation. Although it is possible that no threat actually exists, the person's anxiety prepares him or her for potential threat and thus facilitates avoidance of possible danger.

Unlike fear, which typically arises in response to a specific threatening stimulus, anxiety is more diffuse and not as tied to any particular stimulus or eliciting event. Anxiety is aroused when people perceive situations as uncontrollable and uncertain (Hofmann, 2005). The threat, however, has not yet presented itself; it is not even clear yet whether a threat exists or, if it does, what the nature of the threat will be. In contrast to the narrowing of attention evoked by fear, anxiety is associated with a vigilant broadening of attention in order to detect possible threats. Anxiety is based in a distinct, evolutionarily conserved neural system (Toufexis, 2007). It involves activation primarily in the bed nucleus of the *stria terminalis* (Walker, Toufexis, & Davis, 2003), a structure implicated in slow-onset, long-lasting threat responses – responses that can last even after the threat is gone, or even if no threat exists at all (Walker & Davis, 1997).

Many forms of anxiety can be highly functional. When experienced to an appropriate level and in appropriate situations, anxiety vigilantly prepares the mind and body to avoid harm. Consider the experience of social anxiety. Social anxiety focuses on concerns over negative social evaluation, leading people to worry that others might ostracize or exclude them (Leary, 1990; Baumeister & Tice, 1990; Buss, 1990). Consequently, social anxiety typically leads people to avoid doing things that might bring embarrassment, shame, or rejection. Consequently, social anxiety can be adaptive. Imagine starting a new job with a new set of colleagues. Most people in this situation would experience some degree of social anxiety. The situation is unfamiliar and uncertain, and the person cannot be sure how people will behave. An appropriate level of social anxiety is likely to keep the person's behavior in check, for example, leading the person to refrain from saying anything controversial. This risk-averse self-presentational strategy can help the person avoid any unpleasant interactions until they have a better sense of the local norms.

Thus, social anxiety can be adaptive, helping people maintain their level of social acceptance in valued groups. Yet, as we discuss in the next section, social anxiety can also lead to dysfunctional outcomes. Many of these outcomes arise from the three sources of dysfunction we described earlier: the presence of adaptive tradeoffs, mismatches between current and ancestral environments, and individual differences. Table 2 provides an overview of the three sources of dysfunction described earlier, and highlights their relevance to social anxiety. Understanding these sources of dysfunction can inform intervention and policy efforts designed to reduce problematic forms of social anxiety.

Tradeoffs in Social Anxiety

Social anxiety reflects an essential tradeoff in most interpersonal relationships. On one hand, forming and developing close relationships with other people is an essential part of human life. On the other hand, people can cause each other considerable aggravation, distress, and heartbreak. Developing close relationships with other people, for example, creates the potential for ostracism, rejection, and other forms of social exclusion. Being excluded thwarts people's powerful need for social belonging and can precipitate a psychological state that resembles physical pain (Eisenberger, Lieberman, & Williams, 2003; MacDonald & Leary, 2005).

Thus, a tension exists between forming close relationships, on one hand, and avoiding rejection, on the other. There are potential costs and benefits to any social interaction: In deciding whether or not to approach someone and start a conversation, one could focus on the potential for making a new friend, or one could also focus on the alternative possibility of rejection or embarrassment. Avoiding such an interaction allows one to avoid possible rejection but at the same time requires that one pass up a potentially valuable social opportunity.

The manner in which people navigate this tradeoff is influenced by social anxiety. Because social anxiety is designed to avoid social exclusion, and thus heightens concerns about possible rejection, it leads people to selectively focus on the potential costs associated with social interaction (Foa et al., 1996). One consequence of this selective focus is that people with high levels of social anxiety sometimes overestimate the likelihood of rejection, as well as the distress they would feel if they were rejected (e.g., Gilboa-Schechtman et al., 2000).

Error Management Theory (EMT; Haselton & Buss, 2000) provides a framework for understanding the way socially anxious people navigate cost-benefit tradeoffs in social interaction. EMT begins by acknowledging the tradeoffs that exist in many social situations. Each side of the tradeoff is associated with one type of "error" from an adaptive standpoint. In the case of social interaction, missing out on a social opportunity is an error, just as being rejected is. Often there is an asymmetry in the costliness of the errors on either side of a tradeoff. As one example, imagine someone deciding whether or not to try skydiving. On one hand, choosing not to skydive might lead the person to miss out on a thrilling experience. On the other hand, going skydiving could result in death, which arguably is a larger adaptive error. As such, there may be an asymmetry in the costs of these two errors; the cost of "false negative" (missing out on an exciting experience) is outweighed by the cost of a "false positive" (death). When such an asymmetry exists, adaptive mechanisms usually point people in the direction of the less costly error. Yet, in navigating even such asymmetrical tradeoffs, there is still some cost. Thus, although adaptive mechanisms help people navigate tradeoffs in a way that minimizes negative outcomes (on average), they can nevertheless involve some costs.

In the case of social interaction, interacting with someone who rejects you is an error, because it triggers embarrassment, as well as potential loss of status and ostracism from the

group. On the other hand, avoiding an interaction with someone who is likely to accept you is also an error, one involving the loss of a potentially valuable social opportunity. Social anxiety influences the way people prioritize these two types of errors. In short, anxiety leads people to place greater weight on avoiding possible rejection and embarrassment, thus leading people to avoid social interactions, even when those interactions reflect no real threat.

The costs associated with a particular type of error are partially subjective, in that they reflect people's appraisals of potential outcomes. As mentioned earlier, social anxiety enhances appraisals of social threat, leading people to overestimate the likelihood and severity of rejection. In discussing the presentation of self in everyday life, Erving Goffman noted that every social interaction involves the "real risk of minor embarrassment and only the slight risk of utter humiliation." Thus, virtually all normal social situations involve some potential for embarrassment or social rejection. By prioritizing safety from such negative outcomes, high levels of social anxiety also decrease the odds of forming desirable social connections.

Thus, anxiety can be functional in one way, but dysfunctional in another way. Ultimately, exaggerated or frequent social avoidance can set the stage for a lonely existence, one relatively empty of meaningful social relationships. The irony, of course, is that social anxiety can lead to the very outcome socially anxious individuals fear: social exclusion.

Understanding the way socially anxious people psychologically approach the tradeoffs inherent in social interaction can help inform intervention efforts. Evolutionarily informed research suggests, for example, that biased appraisals of social threat may reflect selective attention to threat (Buckner, Maner, & Schmidt, in press). Such attentional mechanisms are observed in humans and other social species (Öhman & Mineka, 2001). As we will describe later in the paper, interventions designed to reduce attention to threat may reduce problematic forms of social anxiety. Indeed, an evolutionary-cognitive perspective can help supplement existing psychological treatments for anxiety related conditions (e.g., cognitive behavioral therapy; Hope et al., 2006).

Mismatches between Current Environments and Ancestral Environments

Some aspects of modern social environments are substantially different from those that existed for much of human evolutionary history. Consequently, some of the adaptive mechanisms people possess may be somewhat miscalibrated to life in the modern world. This miscalibration can be a source of significant personal and social dysfunction.

One of the main differences between current and ancestral social environments pertains to the size and make-up of the social groups in which people live. Anthropological evidence suggests that, throughout much of human evolutionary history, humans lived in relatively small groups of 50-150 people (Baer & McEachron, 1982). These groups consisted primarily of extended kin networks such that most group members were biologically related (Daly & Wilson, 1997). Modern societies, in contrast, tend to involve many more people than did the social ecologies of the evolutionary past. Moreover, many modern societies, especially Westernized societies, are less centered on biological kin relationships; instead relationships focus on a much wider variety of people – professional colleagues, neighbors, acquaintances, community members, and complete strangers (Daly & Wilson, 1997). Consequently, in western societies people tend to have limited connections with kin-based support networks, relative to what humans have experienced in the past (and relative to what people tend to experience in eastern societies experience today; e.g., Mesquita, 2001).

In addition, social relationships in technologically advanced societies tend to be less permanent than they were throughout evolutionary times (Daly & Wilson, 1997). In ancestral times, people belonged to a particular group for a lifetime. Today, it is not uncommon for people to move from clique to clique within a given community. Moreover, the rise of modern transportation systems has made it much easier to move to a completely different geographic area, which also involves leaving one community of people and joining a different one.

Relationships in modern societies, partly by virtue of their lack of focus on kin, tend to be less communal than those in which we evolved. Relationships among kin tend to be driven by different motives (Ackerman et al., 2007). Kinship relationships typically are characterized by communal sharing, in which people give freely to one another based on people's needs (Clark & Mills, 1993). This tendency fits with theories of inclusive fitness (Hamilton, 1968), which imply that, because biological relatives share a relatively large proportion of one's genes, helping a relative increases one's own reproductive fitness (genetically speaking). Thus people's motives for prosocial behavior toward kin tend to be more altruistic (in the proximate psychological sense). There is more empathy and perspective taking among kin than non-kin (e.g., de Waal, 2008; Maner & Gailliot, 2007). In contrast, resource sharing among non-kin tends to be more utilitarian, exchange oriented, and based on reciprocity. People are less selfless when it comes to non-kin, and non-kin relationships are less characterized by unconditional acceptance.

In sum, although some traditional societies still resemble the group structures in which humans evolved, social relationships in many technologically advanced societies are less centered on kin, are less permanent, and are less selflessly focused on helping one another and providing unconditional support (Moghaddam, Taylor, & Wright, 1993). These differences between traditional and modern groups have important implications for the experience of social anxiety. Relative to traditional societies, the potential for worrying about rejection in modern societies is much higher. It was rare that ancestral humans interacted with complete strangers, but today people frequently interact with strangers and distant acquaintances. Such interactions involve much higher degrees of uncertainty, unfamiliarity, and lack of control.

The consequences of rejection during ancestral times were far more severe than they are today, because people relied more heavily on their group for basic needs like safety and resources. Rejection from an ancestral group likely spelled a very difficult existence or even death. Moreover, people could not easily gain entrance to an alternative group, as people can today. Nevertheless, the level of anxiety people experience today is still calibrated to the costs of rejection from an ancestral group (Buss, 1990). Consequently, the experience of social anxiety can be disproportionate to the actual consequences. Hence, social anxiety can become activated much more frequently today than it did in hunter-gatherer groups and the distress and worry it produces can be disproportionate to the real threat.

Another factor that can give rise to dysfunction involves differences between the modes of social communication used in today's society versus those used in the evolutionary past. Interactions between individuals in the past consisted primarily of direct, face-to-face interaction. This method of interaction is filled with nuance and nonverbal cues that communicate a person's internal states, motives, and intentions; people had immediate access to rich sources of information about what other people were thinking and feeling. In contrast, communication today relies heavily on technology such as email and facebook. Although one consequence is that people can communicate more efficiently with others all over the world, another result is that those communications are relatively devoid of the

verbal and nonverbal cues to which people are so attuned. In short, electronic communication can be dehumanizing.

As face-to-face communication gives way to electronic communication, people could become less in touch with the inner experiences of others – their feelings and motives. Consider how difficult it is to communicate real emotion, excitement, or sarcasm over email. This lack of interpersonal quality may give rise to greater uncertainty in the course of interaction. People may feel less close to others, as they have less immediate contact with other people's emotions and intentions. This uncertainty has potential for increasing social anxiety, as people may be less sure of relationships that lack face-to-face contact. Thus, while the landscape of modern technology can bring people together more efficiently, it may also create gaps that keep people apart.

Understanding the mismatches that exist between modern and ancestral environments can help design interventions and policies to combat dysfunctional forms of anxiety. As we describe later in the paper, for example, situational interventions designed to increase the accessibility of social support from biological kin and to increase the frequency of face-to-face contact with friends, coworkers, and colleagues may help relieve distress among those high in social anxiety.

Individual Differences

Social anxiety reflects a set of universal mechanisms designed to help people manage their relationships with others and maintain their desired level of social acceptance. As such, virtually everyone has the capacity to experience social anxiety. In the normal range, anxiety (like most traits) can be functional. However, there are substantial individual differences in the tendency to experience social anxiety. Some people experience anxiety more strongly and more frequently than others. In the extreme tail of the population distribution, social anxiety can become highly dysfunctional, leading to substantial distress and disability.

Most people experience social anxiety appropriately in particular types of situations, such as asking out a new date or going on a job interview; i.e., situations with uncertain outcomes demanding that people regulate their behavior in a self-presentational way so as to avoid disapproval or rejection. Moreover, the level of social anxiety most people experience is commensurate with the threat implied by the situation. Most situations are only mildly threatening, insofar as they do not realistically threaten the individual's long-term well-being. Being turned down for a date, for example, may sting a bit in the short term, but it does not necessarily carry heavy long-term costs. In such situations, most people tend to feel only mild to moderate levels of social anxiety, and the anxiety they feel helps them effectively regulate their interactions with others. In the normal range, social anxiety is experienced in appropriate situations and to an appropriate degree, and thus social anxiety is functional.

At the upper end of the distribution, however, social anxiety can become problematic. People diagnosed with social anxiety disorder (SAD), for example, experience anxiety that is not appropriately calibrated to the situation. Such individuals experience anxiety in a variety of normal social situations (e.g., meeting a friend for coffee, going to work), which involve little threat of social rejection or embarrassment. Moreover, the level of anxiety they feel tends to be disproportionate to the situation. People with SAD experience extreme distress and hyperarousal, even when the situation affords a minimal level of social threat (Barlow, 2002).

SAD is one of the most prevalent mental disorders, ranking third among all psychiatric conditions (lifetime prevalence 13.3%, Kessler et al., 1994). Anxiety disorders cost the

American health care system approximately \$68.1 billion annually (Greenberg et al., 1999). Among the anxiety disorders, SAD accounts for a substantial percentage of those costs. Although there are two subtypes of SAD – a subtype in which distress is limited to a discrete situation (usually public speaking), and a “generalized” subtype in which distress occurs in many social situations – most individuals with SAD experience impairment across multiple domains including education, employment, family relationships, and romantic relationships. SAD typically begins in childhood or early adolescence, has a chronic course, and often severely disrupts social and occupational functioning (Heimberg et al., 1990). Rates of spontaneous recovery from SAD are low (Davidson et al., 1993). Social anxiety disorder thus represents a significant public health concern due to its prevalence, chronicity, associated impairment, and economic impact.

Our evolutionary view of social anxiety is consistent with dimensional views of psychopathology (e.g., Costello, 1994). A dimensional approach to psychopathology implies that many forms of mental disorder reflect mechanisms that are present in the whole population, but that are operating outside their normal bandwidth (Nesse, 2005). This can be contrasted with a more traditional categorical approach, which presumes that mental disorders reflect processes that are qualitatively different from those displayed by non-disordered individuals (see Lilienfeld & Landfield, 2008). Our view of anxiety disorders is that they reflect adaptive mechanisms present in the whole population and that have functional counterparts within a normal range, but that can become problematic in the extreme range. Extreme forms of social anxiety are associated with most of the same cognitive biases and attunements observed in the normal range – exaggerated attention to and appraisals of threat, hypersensitivity to rejection, disapproval or embarrassment, and avoidance of social situations – only to a greater degree.

The dysfunctional aspects of social anxiety become particularly pronounced when a chronically anxious individual confronts an actual instance of social exclusion. Maner and colleagues (Maner, DeWall, Baumeister, & Schaller, 2007) demonstrated that individual differences in social anxiety were associated with differential responses to social rejection. Participants were exposed to laboratory manipulations of social rejection, for example, being told that a partner did not like them or want to interact with them. Most of those people turned hopefully and optimistically toward new sources of social affiliation, presumably to compensate for the perceived sense of social loss. In contrast, individuals high in social anxiety instead displayed social withdrawal and contempt following rejection. Whereas most people responded to rejection by seeing others in a positive social light (as friendly and inviting), socially anxious individuals instead responded by seeing others as hostile and threatening (see also Vorauer, Cameron, Holmes, & Pearce, 2003). While other people responded to exclusion by behaving generously toward a new interaction partner, socially anxious people reduced their generosity, instead withholding their affection, presumably in an attempt to guard the self from any further pain.

Similarly, Mallott, Maner, DeWall, and Schmidt (2009) exposed people to a social rejection manipulation and then assessed nonverbal indicators of either social affiliation toward a new partner or a desire for social withdrawal (as signaled by eye contact, vocal tone, and body language). Whereas nonanxious people responded to rejection with enhanced signs of affiliation (e.g., increased eye contact with a new partner), socially anxious individuals did just the opposite. They responded by displaying signs of social withdrawal (decreasing their degree of eye contact, assuming a closed body posture).

Even in the absence of any diagnosable disorder, stable individual differences in anxiety are associated with dysfunctional patterns of social perception and behavior (Maner, DeWall et al., 2007). Research on attachment anxiety, for example, suggests that some people are

prone to experiencing chronic anxiety in the context of close relationships. This anxiety can produce maladaptive patterns of attachment and coping, particularly when the relationship is threatened (Simpson et al., 1992). People high in attachment anxiety are highly sensitive to negative thoughts and feelings in their partner. Seeing those thoughts and feelings can have negative implications for felt security and for the exchange of social support in close relationships.

The cognitive processes that characterize individual differences in anxiety may be rooted in basic biological processes. The neuroendocrine system provides a foundation for a broad range of social processes and abnormal endocrinological mechanisms may be associated with psychological disorders, including anxiety disorders. Some research suggests that people with pronounced social anxiety display dysregulated endocrinological processes. Several studies, for example, demonstrate heightened cortisol (Mantella et al., 2008) and alpha-amylase (van Veen et al., 2008) reactivity among people suffering from pronounced levels of anxiety. This fits with evidence that those hormones reflect one's level of stress in response to perceived threat.

More recent evidence suggests that anxiety may be associated with deficits in progesterone. A sizable animal literature demonstrates that anxiety is linked with deficits in the release of progesterone. Blocking progesterone's metabolites in the amygdala or experimentally inducing progesterone withdrawal, for example, increases anxious responding to threat in rats (Bitran, Klibansky, & Martin, 2000). Female rats show increased anxiety levels during points in the estrus cycle associated with low progesterone secretion (Zuluaga et al., 2005). Conversely, high levels of progesterone buffer against anxiety. Exploratory behavior on a maze task, during social interaction, and on defensive burying tasks have been observed in proestrous rats (coincident with the peak in progesterone secretion; Frye, Petralia, Rhodes, 2000). Several studies have also shown that administration of progesterone decreases anxiety in rats (Frye et al., 2006). Progesterone's anxiolytic effects appear to be mediated primarily by the operation of its metabolite (pregnanolone) in the hippocampus (Frye & Walf, 2002) and the amygdala (Jain, Hirani, & Chopde, 2005).

Recent evidence suggests that progesterone might play a similar role in humans. Evidence for anxiety and social withdrawal, for example, have been observed at points in a woman's menstrual cycle that are characterized by low progesterone levels (Fleischman & Fessler, 2009; Schultheiss et al., 2003). Conversely, women on oral contraceptives (which typically contain a progesterone derivative) display higher levels of affiliative motivation and social optimism than do women not on birth control (Schultheiss, Dargel, & Rohde, 2003). Maner, Miller, Schmidt, and Eckel (in press) suggested that social anxiety is linked with deficits in progesterone, particularly when people are faced with threatening social experiences. They demonstrated that, in response to social exclusion, people high in social anxiety displayed a substantial drop in progesterone, signaling distress and a desire for social withdrawal (see also Brown et al., 2009; Schultheiss et al., 2004; Wirth & Schultheiss, 2006). Thus, as in other species, anxiety in humans was linked with deficits in the release of progesterone. These deficits may serve as a biological impetus for social avoidance and withdrawal.

Research on individual differences in anxiety helps identify primary targets for treatment. The evidence for individual differences in endocrinological functioning, for example, is noteworthy, because it suggests novel implications for future forms of pharmacological treatment. In addition, taking a dimensional view of psychopathology helps destigmatize those diagnosed with mental disorders, as they are presumed to display the same processes as normal people, only to an exaggerated degree. The following section elaborates more broadly on implications of the evolutionary framework for policy and intervention efforts aimed at reducing dysfunctional forms of social anxiety.

Implications for Policy and Intervention

The framework described here has significant promise for developing interventions and policies aimed at combating personal and social dysfunction. We have suggested that dysfunctional outcomes sometimes are rooted in adaptive psychological mechanisms gone awry. As we noted earlier, evolved mechanisms are not immune to change, but are instead calibrated to relevant variations in the environment. In order to combat forms of dysfunction, it is important to understand not just the surface characteristics of a phenomenon, but also its root causes. An evolutionary perspective can be useful because it points to the specific psychological mechanism(s) that may ultimately give rise to problems and thus helps identify useful targets for intervention. In the sections below we describe possible implications of the current framework for psychological, situational, and biological interventions. Our approach also helps identify at-risk populations, so that interventions can be appropriately tailored and targeted to appropriate individuals. Most of the intervention strategies and policy implications we discuss are new; hence aspects of our discussion are necessarily speculative.

Psychological Interventions

Current psychosocial treatments for anxiety-related problems focus on restructuring the way people think about and behave in anxiety-provoking situations. These treatments – typically in the form of cognitive behavioral therapy (CBT; e.g., Hope et al., 2006) – focus on altering people's subjective appraisals of situations perceived as threatening. Treatments for social anxiety provide education to help people develop cognitive skills for appropriately assessing the potential for threat in everyday social interactions, so that they do not overestimate the likelihood of rejection or disapproval. Consistent with experimental work on rejection (Maner et al., 2007; Vorauer et al., 2003), anxious individuals benefit from reappraising social interactions as opportunities for social connection, rather than as social threats to be avoided. In addition, existing treatments help people develop social skills, in part through repeated exposure to normal social situations. Over time, such exposure typically helps reduce anxiety (Hope et al., 2006). Thus, existing treatments for anxiety tend to focus on restructuring people's appraisals of threat, as well as developing people's social skills (Barlow, 2002).

An evolutionary approach suggests that appraisals of threat are rooted in more basic cognitive and perceptual processes that are common among species (Öhman & Mineka, 2001). Recent work from our labs, for example, suggests that self-protective motives lead people to selectively attend to and encode threatening social stimuli (Maner et al., 2005; Miller, Maner, & Becker, in press). Thus, an evolutionary perspective suggests underlying mechanisms that may serve as useful targets for psychological intervention.

Indeed, recent research on attention to threat suggests an intriguing possibility for intervention: training people to attend away from threat, rather than toward it. Anxiety is associated with selective attention to threat (MacLeod, Mathews, & Tata, 1986). On entering a room full of strangers, for example, an anxious individual may selectively attend to signs of social disapproval from others (Buckner et al., in press). Schmidt et al. (2009) tested an attention training program for reducing anxiety among a sample of social anxiety disorder patients. The program trained people to quickly disengage their attention from threat cues (angry faces) and to attend instead to signs of social affiliation or safety (smiling faces). Patients in the attention training condition displayed significant reductions in anxiety symptoms following the program. The reductions in anxiety were so dramatic that three-quarters of the patients receiving training no longer satisfied diagnostic criteria for social anxiety disorder (compared to only 11% in a control condition). Moreover, these benefits were still apparent at a 4-month follow up. These results are consistent with evolutionary

models, which imply that self-protective processes are rooted in basic cognitive mechanisms (Öhman & Mineka, 2001).

Thus, interventions could be designed to help people – even those not suffering from an anxiety disorder – to attend preferentially to sources of positive social affiliation, rather than sources of disapproval. Notably, the reductions in anxiety symptoms demonstrated by Schmidt and colleagues were observed in response to a simple computer task. Such tasks could reflect inexpensive and easy-to-implement vehicles for treatment, particularly because such programs could be delivered over the internet. Indeed, one treatment obstacle is that social anxiety can make people resistant to seeking help, because treatment typically requires interacting with a therapist. Automated forms of initial treatment could be delivered remotely and, though they may not be as effective as full-blown CBT (Barlow, 2002; Hope et al., 2006), they could provide valuable supplements to traditional treatment interventions.

As we have noted, there are substantial individual differences in social anxiety, and only some proportion of individuals (those in the tail of the population distribution) are likely to require intervention. Signs of abnormal social avoidance should serve as a cue that an individual might benefit from intervention. Many people are in a position to deliver informal types of intervention to those in need: educators, parents, physicians, employers, and close others. At the extreme end of the continuum, people with diagnosable forms of anxiety should seek treatment from qualified professionals.

It should be noted that we do not recommend that interventions eliminate people's experience of anxiety or reduce it below normative levels. As we have noted through this paper, when experienced within the normal range, anxiety is functional and facilitates productive social interaction. Thus, the goal of any intervention should be to alter people's experiences of social anxiety so that they are appropriate to the situation and experienced to an appropriate level.

Situational Interventions

As we described earlier, one source of anxiety pertains to the mismatch between current environments and ancestral environments. In particular, although people are evolved to interact primarily with tight-knit groups of kin and close others, people today interact with a much wider variety of individuals, including distant acquaintances and complete strangers. Such interactions involve relatively high degrees of uncertainty and therefore can give rise to anxiety about possible rejection or disapproval.

It is not realistic to suggest that people drastically reduce their interactions with acquaintances or strangers; life in the modern world requires such interactions. We do recommend, however, creating greater balance in people's social networks. One method would be to encourage greater interaction with biological kin, who are (given the natural incentive of shared genes) much more apt than other individuals to provide support (Ackerman et al., 2007). Social policies could be designed to increase people's ability to maintain ties with kin and should create incentives for protecting kinship relationships: e.g., financial incentives that reward people who live near or frequently visit relatives and provide care to them (which could simultaneously reduce reliance on public health care systems); reductions in fees for travel to and communication with family. Interventions could educate people about the increased social capital associated with living closer to family members, and the increased stress associated with living further away (Magdol, 2002; Magdol & Bessell, 2003). Proximity to close relatives can also provide direct financial benefits via willingness to provide child care and other forms of direct assistance. Making people aware of the magnitude of these benefits and costs could change the equation when

people are considering alternative job offers, and perhaps focusing on a higher salary that would require relocation.

Another situation-focused intervention would be to help people develop strong networks of close relationships, as interactions with close others afford high degrees of certainty. This is particularly important during life transitions in which people move from one place to another, causing an abrupt disruption in their social network and potentially a loss in immediate social support. Consider the transition to college. Educational institutions could devote greater energy toward helping people form sustained and interdependent cohort groups that display a high degree of permanence over time. Such groups could serve as a proxy for kin groups, should those not be immediately available, and could reduce uncertainty and anxiety. Although such groups certainly can form on their own, it would be beneficial to provide alternative means for facilitating the formation of such groups, particularly for those whose levels of social anxiety might preclude spontaneous interactions with strangers.

Similarly, starting a new job or moving to a new community can serve as sources of acute social stress and uncertainty. Employers might benefit from devoting greater effort to reducing social anxiety experienced by new employees. Beyond an initial orientation, for example, employers might pair new workers with another employee who could provide informational and emotional support. For individuals moving to a new community, social agencies could devote resources toward helping those individuals acclimate to their new environment by providing concrete sources of social support (e.g., recreational groups for new community members). Some cities already have infrastructures established to provide such support, and they could serve as models for the further development of acclimatization support networks in other areas. Existing systems are typically designed to be more appealing to people low in social anxiety. Those high in social anxiety might profit from explicit attempts to pair them up with specific neighbors who could mentor their initial entry into existing groups.

Organizations could also encourage the use of more direct interpersonal communication. As noted earlier, people's perceptual systems are not designed for communication in the electronic age; rather they are designed to be sensitive to nuances of verbal and nonverbal behavior in the context of face-to-face interaction. Although the prevalence of email has perhaps increased work efficiency, it can also deprive people of essential opportunities for direct social interaction. People might benefit from organizational environments that encourage social gathering (common rooms, in which people can congregate) and informal social events that provide opportunities for direct social interaction. Such interactions can help people habituate to the constraints of normal conversation, and defuse potential problems associated with social isolation. Email and facebook are "safe," in the sense that they reduce the potential for distress associated with face-to-face interaction. In the long-term however, over-reliance on electronic communication may inhibit the development or maintenance of essential social skills.

Biological Considerations

An emerging literature suggests important links between endocrinological processes and anxiety. Although implications for intervention and treatment are speculative, this literature does suggest intriguing possibilities for efforts aimed at understanding and targeting dysfunctional patterns of anxiety. Prevailing theories presume that social anxiety is fundamentally rooted in basic biological processes (Barlow, 2002). Despite this presumption, however, empirical studies have failed to fully explore the role biological processes play in anxiety. Funding policies would benefit from placing greater priority on translational studies designed to identify and investigate biological causes and consequences

of anxiety. Within the scientific community, this would involve greater interaction and collaboration among basic behavioral scientists (e.g., social psychologists), biological scientists, and clinical scientists.

The available literature may also help identify populations at risk for developing problems with anxiety. As we discussed, deficits in the release of progesterone are associated with social anxiety and may even be a precursor to developing social anxiety problems. Certain populations experience dysregulated progesterone processes (e.g., women going through menopause), and thus efforts should be directed toward helping such individuals avoid problems that may arise during periods of acute hormonal change or dysregulation. In addition, women not on hormonal contraceptives display natural fluctuations in hormones such as progesterone throughout their menstrual cycle. Such fluctuations have been associated with anxiety symptomatology (Fleischman & Fessler, 2009; Schultheiss et al., 2003). Thus, women should be educated about the potential psychological changes that could accompany changes across their menstrual cycles, and efforts should be directed toward buttressing their sources of social support and close relationships during periods of low progesterone (the follicular phase). Such educational interventions could be incorporated into normal interactions between women and their primary care physicians.

Although the literature is too preliminary to offer direct suggestions for pharmacological treatment, future research should be directed toward assessing whether hormonal treatments might supplement current treatments for anxiety. Experimental administration of progesterone in rats, for example, has been shown to reduce anxiety and avoidance in non-human species (Frye et al., 2006). There also is evidence that administration of testosterone – another hormone implicated in social anxiety (Maner, Miller, Schmidt, & Eckel, 2008) – decreases anxiety in humans (van Honk et al., 2005). Such findings suggest intriguing possibilities for pharmacological treatments aimed at reducing dysfunctional patterns of anxiety. Funding agencies might benefit from providing support to investigations that explore such opportunities.

The Broader Utility of the “Adaptations Gone Awry” Framework

Although the current paper has focused on applying an evolutionary framework to dysfunctional patterns of anxiety, anxiety is only one of many social problems that could benefit from an evolutionary analysis (see Cosmides & Tooby, 1999; Crawford, 1998; Nesse, 2005). Humans are evolved to face myriad challenges in many social domains including forming romantic relationships, navigating status hierarchies, avoiding disease, and caring for offspring (see Table 3). Although adaptive psychological mechanisms help people solve such challenges, those mechanisms can cause dysfunction when a) the tradeoffs are such that solving one problem makes people susceptible to another, b) the nature of the challenge is substantively different from how it existed in ancestral times, or c) individual differences in the mechanism’s operation are associated with dysfunctional behavior in the extreme range.

Consider mechanisms designed to maintain and protect long-term romantic relationships. Long-term relationships can provide tremendous adaptive benefits by satisfying people’s need for social bonding and facilitating the long-term care of offspring. Consequently people possess mechanisms to help them protect their relationship when threatened. Although people can be tempted by infidelity, for example, people also have mechanisms designed to downregulate the threat of attractive relationship alternatives. For instance, people often remain inattentive to those alternatives (Maner, Gailliot, & Miller, 2009; Maner, Rouby, & Gonzaga, 2008) or derogate them (Lydon et al., 2003).

Yet, there are inherent tradeoffs associated with maintaining a relationship in the face of desirable alternatives. From a purely reproductive standpoint, sometimes it would be beneficial to engage in extra-pair relationships or to leave a current partner for a new one (Scheib, 2001). Consequently, when the reproductive benefits of straying from a long-term relationship outweigh the reproductive benefits of staying, an individual may be inclined to leave the relationship. Thus, although mechanisms designed to navigate this tradeoff may increase reproductive success, they may also lead to relationship conflict, infidelity, and high divorce rates (see Barash & Lipton, 2001). Understanding the nature of the trade-offs can provide valuable insight into the factors that set the stage for problematic behaviors in close relationships.

In addition, natural cognitive mechanisms designed to decrease attention to attractive relationship alternatives are not designed to deal with the constant influx of images from the media, many of which depict unrealistically attractive people who can threaten one's satisfaction with a current partner (Kenrick et al., 2004; Gutierres, Kenrick, & Partch, 1999). Such exposure is a novel characteristic of modern media, and was not present in ancestral social environments. This mismatch between current and ancestral environments may lead people to become overwhelmed by exposure to attractive relationship alternatives, thus decreasing commitment to and satisfaction with long-term relationships. One implication is that, to aid in the success of long-term relationships, people (particularly those experiencing relationship problems) may benefit from limiting their consumption of some types of popular media.

As another example, jealousy is regarded by evolutionary psychologists as a mechanism designed to help people ward off threats posed by romantic competitors (Buss et al., 1992; Maner, Miller, Rouby, & Gailliot, 2009). Yet, there are tradeoffs associated with intrasexual rivalry. Although jealousy may help people protect against romantic interlopers, it can also be a source of significant distress and relationship conflict (Buss, 1988). Indeed, concerns about infidelity serve as one of the main triggers for relationship violence (Puente & Cohen, 2003; Vandello & Cohen, 2003; see also Daly & Wilson, 1996). Moreover, just as exposure to highly attractive members of the opposite sex (e.g., in the modern media) can reduce one's commitment to a relationship, exposure to highly attractive members of one's own sex may lead to dysfunctional patterns of jealousy and relationship insecurity (Gutierres et al., 1999). Individual differences in jealousy can also be a source of dysfunction: although most people experience jealousy in a normal range that is appropriate to the situation, some individuals display extreme jealousy that can cause major relationship dysfunction (Easton, Schipper, & Shackelford, 2007). Thus, although adaptive psychological mechanisms are designed to help people navigate particular challenges associated with maintaining long-term relationships, those mechanisms can also be sources of significant dysfunction, including domestic violence, infidelity, and divorce.

Indeed, many of the challenges that humans face have led to the evolution of mechanisms that can be highly functional at one level, yet highly dysfunctional at another. Mechanisms designed for disease avoidance have been implicated as a cause of stigmatization of individuals who appear different in some way (e.g., obese people or individuals of other ethnicities; Kurzban & Leary, 2001). Mechanisms designed to help people avoid physical harm may promote forms of racial and ethnic prejudice (Maner et al., 2005; Schaller, Park, & Faulkner, 2003). Mechanisms designed to help men form romantic relationships with women can lead them to engage in dangerous forms of risky behavior and violence (Baker & Maner, 2001; Daly & Wilson, 2001). And mechanisms designed to facilitate situationally specific group leadership may lead to corruption and abuse in modern organizations, as leadership roles often span beyond the leader's domain of expertise (van Vugt et al., 2008). In each case, adaptive mechanisms designed ultimately to enhance survival and reproduction

can nevertheless cause destructive consequences at a proximate level. Interventions and policies designed to ameliorate these destructive consequences ought to target the specific motivations (e.g., self-protective motives, mating motives) underlying the dysfunctional pattern of behavior (see Griskevicius et al., 2007).

Conclusion

We have focused on social anxiety to consider how otherwise functional psychological mechanisms can go awry. Similar issues involving trade-offs, environmental mismatches, and individual differences apply to a host of maladaptive social behaviors. From infidelity and relationship violence to international conflict and intergroup prejudice to the destruction of the environment and the rapid explosion of human population growth, many of the problems humans face involve the operation of evolved psychological mechanisms. The current paper provides a framework for understanding evolved psychological processes as significant sources of dysfunction. This framework also allows us to look hopefully toward new policies and interventions designed to combat many of society's problems. Understanding the root causes underlying problematic behaviors is an essential step toward reducing the pain those problems can cause.

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Table 1

Some adaptive mechanisms, their maladaptive consequences, and potential implications for intervention

Adaptive Mechanism	Potential Maladaptive Consequence	Implications for Intervention & Policy
Jealousy is designed to help people maintain long-term relationships by warding off potential romantic competitors (Maner, Miller, Rouby, & Gailliot, 2009).	Jealousy can trigger relationship violence. Some people tend to overestimate the degree of threat posed by same sex rivals, becoming hyper-vigilant to potential infidelity (Puente & Cohen, 2003).	Interventions with couples could reduce cognitive processes that promote unnecessary jealousy and concern over infidelity; help couples avert and deal appropriately with potential infidelities so they do not lead to violence.
Mechanisms designed to help people protect themselves from harm tend to selectively target outgroup members (Maner et al., 2005).	Self-protective mechanisms respond to feelings of fear by promoting prejudicial responses to particular racial groups (e.g., African-American men; Schaller, Park, & Faulkner, 2003).	Policies should prioritize the development of safe and secure environments for interracial interaction, thus reducing the likelihood of fear-induced prejudice.
Disease avoidance mechanisms are designed to promote avoidance of individuals displaying heuristic cues of disease (Ackerman et al., 2009).	Some heuristic cues to disease are harmless (e.g., birthmarks, physical disabilities, disfigurement), but nevertheless people tend to avoid people displaying such cues (Schaller, Park, & Faulkner, 2003).	Policies and interventions should attempt to combat unfounded disease-related stereotypes of individuals with heuristic disease cues; promote opportunities for safe and structured contact with such individuals.
Status-striving mechanisms are designed to attain dominance and reproductive advantages over others (Sadalla, Kenrick, & Vershure, 1987).	Status-striving mechanisms can promote interpersonal aggression and risk-taking, particularly among adolescent males (Wilson & Daly, 1992).	Policies should direct efforts toward giving adolescent males safe and productive means of competing with others and attaining a sense of status and dominance.
Attraction mechanisms promote somewhat different mating strategies in men (who lean toward short-term mating) and women (who lean more toward long-term mating) (Kenrick, Li, & Butner, 2003)	Sex differences in mating strategies lead to conflict between the sexes (e.g., disagreements regarding timing to first intercourse) (Buss & Schmitt, 1993)	Men and women should be educated about the sources of this conflict between the sexes, so that they can make informed decisions about their mating-related behaviors

Table 2

Three Sources of adaptive dysfunction

Source of Dysfunction	Description	Illustrative Example	Relevance to Social Anxiety
The presence of adaptive tradeoffs	Although an adaptive mechanism typically helps solve a problem, it almost always does so at some cost.	Competitiveness and risk-taking among men can increase their attractiveness to women, but can also lead to conflict and injury.	Although social anxiety can help people avoid disapproval or rejection, it promotes social avoidance and thus may cause loneliness, distress, and social impairment.
Mismatches between modern and ancestral environments	An adaptive mechanism designed to serve some function in ancestral environments may misfire if current environments differ substantively from ancestral ones.	Preferences for sugar and fat promoted the selection of nutritious foods in ancestral times but, due to modern processed foods, this preference can cause myriad health problems today.	Ancestral groups consisted primarily of highly interdependent kin networks. Today, people interact with a much wider variety of unrelated people, which can give rise to substantial uncertainty and social anxiety.
Individual differences	Although adaptive mechanisms may perform well across the normal range of functioning, they can become dysfunctional in the tails of the population distribution	Although all people display a need for social bonding, excessive dependency (or detachment) can lead to maladaptive relationship behavior.	In the normal range, some degree of social anxiety can prevent embarrassment and inappropriate behavior. In the extreme range, anxiety can become exaggerated, and can lead to avoidance of appropriate and potentially rewarding opportunities for social interaction.

Table 3

A framework for conceptualizing social dysfunction across domains

	Tradeoffs	Mismatches	Individual Differences
Affiliation	Social anxiety helps people maintain acceptance, but can also produce distress and social impairment, particularly in the face of social rejection (Maner, 2009).	Ancestral groups consisted primarily of kin, who afforded unconditional support; modern groups are more diverse, less permanent, and based more on reciprocity (Dunbar, 1992).	Normal levels of social anxiety are highly functional. In the extreme range, however, pronounced social anxiety can impair social functioning (Barlow, 2002).
Mate search	Men often are motivated to seek multiple short-term sexual partners, but this can hinder their ability to maintain long-term relationships (Buss & Schmitt, 1993).	With the advent of modern media, people are exposed to unrealistically attractive images. This can bias the standards people use in evaluating current or prospective partners (Kenrick et al., 1994).	People displaying highly unrestricted attitudes toward casual sex may have trouble maintaining relationships and may be susceptible to sexually transmitted infections (Gangestad & Simpson, 2000).
Relationship maintenance	Jealousy may help guard against romantic rivals, but can also lead to insecurity and relationship violence (Puente & Cohen, 2003).	As above, media exposure to highly attractive same-sex images can produce relationship insecurity by implying an unlimited pool of attractive interlopers (Gutierrez et al., 1999).	In the normal range, jealousy may be functional; extreme forms of jealousy, however, can be highly problematic and is a trigger for domestic violence (Easton et al., 2007).
Self-Protection	The emotion of fear can help people avoid danger, but it consumes energetically costly psychological and physiological resources (Öhman & Mineka, 2001).	Humans may have evolved to fear members of outgroups; today most outgroup members are not hostile, but fear nevertheless leads to outgroup prejudice (Maner et al., 2005).	People who display an exaggerated propensity for fear may have difficulty engaging in normal tasks that require some degree of risk (Barlow, 2002).
Status	The desire for status can make men more attractive to potential mates, but it may lead them to engage in dangerous forms of intrasexual competition or risk-taking (Wilson & Daly, 2004).	The power of ancestral leaders typically had limited scope; modern organizations allow for much greater levels of power, giving rise to corruption and abuse (Van Vugt et al., 2008).	People who over-derive their self-worth from being higher status than others (e.g., narcissists) are prone to experiencing relationship problems and aggression (Campbell et al., 2002).
Disease	Vigilance to signs of potential disease in others can help people avoid contagion, but it can also cause unnecessary social avoidance (Ackerman et al., 2009).	In ancestral times, people who looked different may have carried pathogens; today, people stigmatize distinctive looking others, even though they may be quite safe (Kurzban & Leary, 2001).	Individuals displaying extreme avoidance of any potential sources of contagion (e.g., people with obsessive compulsive disorder) have difficulty functioning in society (Schaller et al., 2003).